Engineering MoS_2: Sulfur Vacancy Patterning for Tunable Properties

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Defect engineering in MoS_2 is a powerful tool to tailor its electronic and functional properties. In this work, we employ surface defect electrochemical nanopatterning as a scalable method to create sulfur vacancy-rich domains with sub-micrometer resolution, alternating with defect-free regions over large areas.[1] This controlled patterning significantly modifies the optical, electronic, and catalytic properties of MoS_2. To gain deeper insight into these modifications, Kelvin probe force microscopy (KPFM) is used to monitor work function changes[2], while conductive AFM (c-AFM) probes local conductivity variations. Our results highlight defect nanopatterning as a promising approach for tuning MoS_2 properties at the nanoscale, with potential applications in energy conversion and catalysis.

References

[1] Denis Gentili et al., Small Methods 2024, 2401486
[2] V. Palermo et al., Adv. Mater., 2006, 18: 145-164

Figures

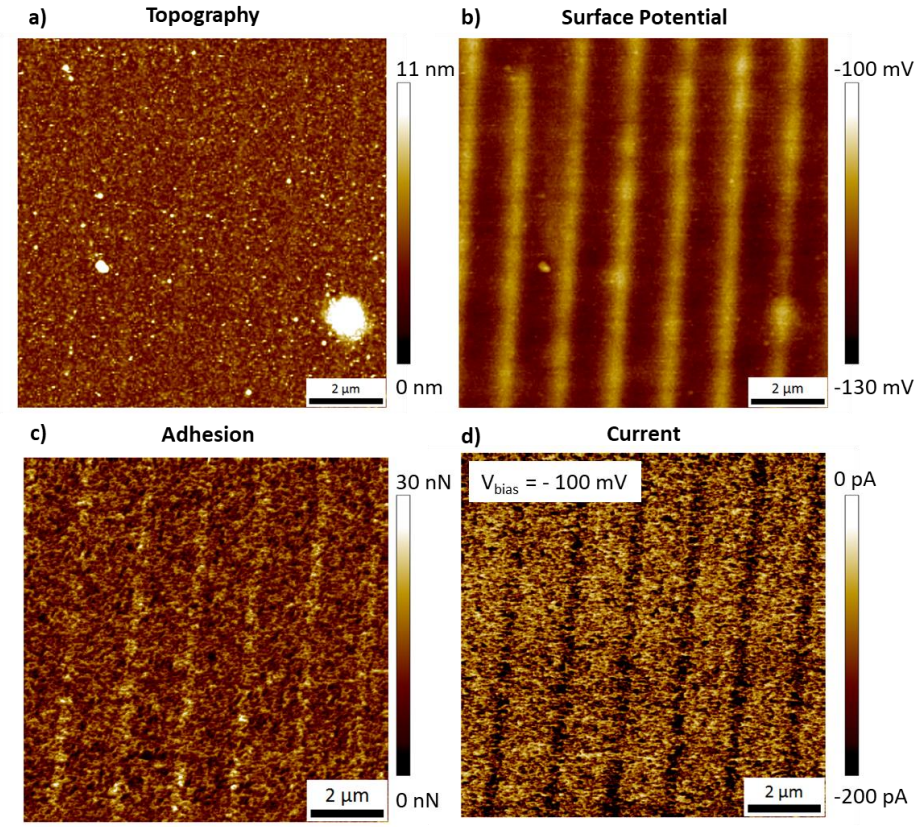

Figure 1: a) AFM topographic image of the patterned zone. b) Surface potential map on a close area. c) Corresponding adhesion map and d) Conductive AFM map (Vbias=−0.1 V) of the topography shown in (a). Vs-rich stripes exhibit a significant increase in electrical conductivity (30% more than pristine zones).